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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/059,321

01/31/2002

Chuan Lin

2001 P 14585 US

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12/23/2003

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EXAMINER

ISAAC, STANETTA D

ART UNIT

PAPER NUMBER

2812 ,

DATE MAILED: 12/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/059,321

Applicant(s)

LIN, CHUAN

Examiner

Stanetta D. Isaac

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 03 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_. 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Information Disclosure Statement*

1. The information disclosure statement (IDS) submitted on 11/03/03 was filed after the mailing date of the Examiner's Amendment on 9/26/03. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 11, 13-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Cheng et al. Patent Application Publication 2002/0182826.

4. Cheng discloses the semiconductor method substantially as claimed. See **FIGS. 1-3G** where Cheng teaches a method of forming a semiconductor structure, the method comprising:

Providing a semiconductor substrate **300**;

forming a trench **306** within the semiconductor substrate, the trench including upper top corners after forming the trench, implanting fluorine **308** into the upper top corners of the trench, the implanting being performed at a large tilt angle; and

and after implanting fluorine, filling the trench **316** with an insulating material.

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5. Pertaining to claim 13, Cheng teaches the method of claim 11 wherein providing a semiconductor substrate comprises providing a semiconductor substrate having a pad oxide formed over a portion thereof and a nitride layer formed over the pad oxide.
6. Pertaining to claim 14, Cheng teaches the method of claim 11 wherein implanting fluorine comprises implanting fluorine in sufficient amounts to affect reduction of negative bias temperature stability and enhance gate oxidation at the STI corners.
7. Pertaining to claim 15, Cheng teaches the method of claim 11 wherein filling the trench comprises performing a high density plasma oxide deposition.
8. Pertaining to claim 16, Cheng teaches the process of claim 11, wherein said large tilt angle is from about 10 to about 30 degrees with reference to the Y axis.
9. Pertaining to claims 9 and 10, Cheng teaches the process of claims 7 and 8, wherein said high density plasma (HDP) fill is HDP oxide fill.
10. Pertaining to claim 17, Cheng teaches the method of claim 11 and further comprising forming a P-channel transistor in a region of the substrate adjacent the filled trench.
11. Pertaining to claim 18, Cheng teaches the process of claim 11, wherein said sufficient amount of F<sub>2</sub> is a dose of from about  $5 \times 10^{12}$  to about  $1 \times 10^{14}$  cm<sup>2</sup>.

***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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13. Claims 1-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng et al. Patent Application Publication 2002/0182826.

14. Pertaining to claims 1 and 12, Cheng discloses the invention substantially as claimed. See **FIGS. 1-3G** where Cheng teaches in a process of fabricating a narrow channel width PMOSFET device, the improvement of affecting reduction of negative bias temperature instability by use of F<sub>2</sub> side wall implantation, comprising:

a) forming a shallow trench isolation (STI) region **306** in a substrate having a pad oxide **302** and a nitride layer **304** on it's surface;

b) forming a liner layer in said shallow trench isolation region and subjecting said liner layer to oxidation to form STI liner oxidation layer; and

d) filling the STI F<sub>2</sub> implanted structure from step c) with a high density plasma (HDP) fill to affect reduction of negative bias temperature instability and enhance gate oxidation at the STI corner.

15. However, Cheng fails the step of c) after forming the STI region and forming liner layer, implanting F<sub>2</sub> into upper top corners of said STI liner oxidation layer at a large tilted angle in sufficient amounts to affect reduction of negative bias temperature instability and enhance gate oxidation at the STI corner after a high density plasma fill of said STI F<sub>2</sub> implanted liner oxidation layer. See **paragraphs [0020] –[0021]** where Cheng discloses that a thicker oxide layer is thus formed at the area where fluorine ions are implanted (at a tilt angle) than at the area where ions are absent, in addition, the rate of oxidation increases to form a liner oxide layer with a greater thickness than the other area. In view of Cheng it would have been obvious to one of ordinary skill in the art to substitute forming the oxidation layer and then implanting F<sub>2</sub> into the

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upper top corners of the STI liner oxidation layer at a large tilted angle because the thickness of the oxidation layer would prove to be equivalent due to the fact that whether the fluorine ions are implanted into the upper corners of the trench at an angle before or after the oxidation liner layer is formed would still increase the thickness of the oxidation liner layer.

16. Pertaining to claim 2, Cheng teaches the process of claim 1 wherein said substrate is Si.

17. Pertaining to claim 3, Cheng teaches the process of claim 2 wherein said liner oxidation layer is SiO<sub>2</sub>.

18. Pertaining to claim 4, Cheng teaches the process of claim 2 wherein said liner oxidation layer is SiON.

19. Pertaining to claims 5 and 6, Cheng teaches the process of claims 3 and 4, wherein said large tilt angle is from about 10 to about 30 degrees with reference to the Y axis.

20. Pertaining to claims 7 and 8, Cheng teaches the process of claims 5 and 6, wherein said sufficient amount of F<sub>2</sub> is a dose of from about  $5 \times 10^{12}$  to about  $1 \times 10^{14}$  cm<sup>2</sup>.

21. Pertaining to claims 9 and 10, Cheng teaches the process of claims 7 and 8, wherein said high density plasma (HDP) fill is HDP oxide fill.

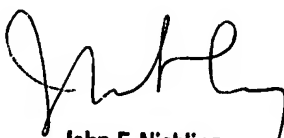
22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stanetta D. Isaac whose telephone number is 703-308-5871. The examiner can normally be reached on Monday-Friday 7:30am -5:30pm.

23. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 703-308-3325. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722.

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24. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Stanetta Isaac  
Patent Examiner  
December 18, 2003



John F. Niebling  
Supervisory Patent Examiner  
Technology Center 2800